BAYOU DES CANNES TMDL FOR FECAL COLIFORM

SUBSEGMENT 050101

US EPA Region 6

With cooperation from the
Louisiana Department of Environmental Quality
Office of Environmental Assessment
Environmental Technology Division

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EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to identify waterbodies that are not meeting water quality standards and to develop total maximum daily pollutant loads for those waterbodies.   A total maximum daily load (TMDL) is the amount of a pollutant that a waterbody can assimilate without exceeding the established water quality standard for that pollutant. Through a TMDL, pollutant loads can be distributed or allocated to point sources and nonpoint sources discharging to the waterbody.   A TMDL for the May – October season has been developed for fecal coliform bacteria for Bayou Des Cannes. Fecal coliform bacteria are monitored as the indicator for potential human health threats resulting from swimming.

Bayou Des Cannes flows from its headwaters into the Mermentau River. Bayou Des Cannes segment 050101 was listed on both the 1998 and the October 28, 1999 Court Ordered §303(d) Lists as not fully supporting the water quality standard for primary contact recreation (swimming). Louisiana's water quality standard for protection of the primary contact recreation use reads as follows:

> "Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 200/100mL, nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 400/100mL. These primary contact recreation criteria shall apply only during the defined recreational period of May 1 through October 31. During the non-recreational period of November 1 through April 30, the criteria for secondary contact recreation shall apply."

The standard for secondary contact recreation reads similarly:

> "Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 1,000/100 mL, nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 2,000/100 mL."

Five years (January, 1994 – December 1998) of monthly LDEQ monitoring data on Bayou Des Cannes (collected northeast of Jennings) was assessed to determine if the primary and secondary contact recreation uses were being maintained. Analysis of the data for the November – April season shows that the secondary contact recreation use is being maintained (see Appendix A). Analysis of the data for the May – October season shows that the primary contact recreation use is not protected (see Appendix A). Therefore, a TMDL has been developed to protect the May – October season.

For the purpose of calculating current loading on Bayou Des Cannes the average fecal coliform concentration for the May – October season was calculated using monthly LDEQ monitoring data on Bayou Des Cannes northeast of Jennings. In Bayou Des Cannes, the monthly fecal coliform counts for this season range from 7 cfu/100ml to 1,300 cfu/100ml over the 5-year period (January, 1994 – December, 1998).

For the purpose of TMDL development, the criterion of 200/100mL was applied. A fecal coliform loading curve for the recreational period (May 1 – October 31) has been generated as Figure 1. This loading curve was developed using Equation 1, substituting the criterion, 200 cfu/100 ml, for FC concentrations and varying flows. The attempt here is to show that while a TMDL may be expressed as a single point it can also be thought of as a continuum of points representing the criterion value and various flow values. A 35% reduction in fecal coliform loading during the May – October season will be needed to protect the primary contact recreation use.

1. Introduction

Bayou Des Cannes segment 050101 was listed on both the 1998 and the October 28, 1999 Court Ordered §303(d) Lists as not fully supporting the water quality standard for primary contact recreation (swimming). On the 1998 List, this segment was ranked as a high priority (1) for TMDL development.   A TMDL for fecal coliform bacteria was developed in accordance with the requirements of Section 303 of the federal Clean Water Act. The purpose of a TMDL is to determine the pollutant loading that a waterbody can assimilate without exceeding the water quality standard for that pollutant; the TMDL also establishes the load reduction that is necessary to meet the standard in a waterbody. The TMDL consists of the wasteload allocation (WLA), the load allocation (LA), and a margin of safety (MOS). The wasteload allocation is the load allocated to point sources of the pollutant of concern, and the load allocation is the load allocated to nonpoint sources. The margin of safety is a percentage of the TMDL that accounts for the uncertainty associated with the model assumptions, data inadequacies, and future growth.

2. Study Area Description

2.1 General Information

Water quality segment 0501 is part of the Mermentau River Basin. The Basin encompasses the prairie region of the state and a section of the coastal zone. Bayou Des Cannes is located in southwestern Louisiana in the Mermentau River Basin. The Mermentau River Basin is bounded on the north and east by the Vermilion-Teche Basin, on the west by the Calcasieu Basin and southward by the Gulf of Mexico. Land resources of the Mermentau River Basin consist of low relief prairie land interspersed with trees that line stream banks and some wetland areas. Natural vegetation in this region is comprised of bluestem, broomsedge, water grass, and switch grass. Vegetation introduced to the vicinity includes Johnson grass and carpet grass. The well-developed soil profile consits of dark to grey topsoil with an impervious claypan located approximately 14 inches below the surface. This claypan is conducive to rice farming because it holds water necessary for irrigation of the crops. Soybeans and crawfish are rotated with the rice crops. The average annual rainfall in the vicinity of Bayou des Cannes is approximately 57 inches. The land use for Bayou des Cannes watershed is summarized in Table 1.

Table 1. Land Uses in Subsegment 050101

LAND USE TYPE	NUMBER OF ACRES	% OF TOTAL AREA
Urban	4,092	2.55
Barren Land	86	0.05
Agricultural	121,401	75.75
Forest Land	18,853	11.76
Water	3,209	2.00
Wetland	9,055	5.65
Rangeland	3,561	2.22
Other	32	.02
TOTAL AREA	160,257	100

The area is sparsely populated outside its small municipalities and land use is dominated by agriculture.

2.2 Water Quality Standards

The designated uses for Bayou Des Cannes include both primary contact recreation and secondary contact recreation. Fecal coliform bacteria serve as the indicator used for the water quality criteria and for assessment of use support. Louisiana's water quality standard for protection of the primary contact recreation use reads as follows:

> "Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 200/100mL, nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 400/100mL. These primary contact recreation criteria shall apply only during the defined recreational period of May 1 through October 31. During the non-recreational period of November 1 through April 30, the criteria for secondary contact recreation shall apply."

The standard for secondary contact recreation reads similarly:

> "Based on a minimum of not less than five samples taken over not morethan a 30-day period, the fecal coliform content shall not exceed a log mean of 1,000/100 mL, nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 2,000/100 mL."

2.3 Identification of Sources

The sources identified in the *1998 Louisiana Water Quality Inventory* as affecting the water quality of Bayou Des Cannes are unknown sources (LDEQ, 1998).

2.3.1 Point Sources

There are 29 facilities discharging sanitary wastewater into Bayou Des Cannes and its tributaries. The combined flow of all these discharges is 3,301,966 gallons per day (see Appendix B for list of all possible dischargers).

2.3.2 Nonpoint Sources

The predominant land uses in the Bayou Des Cannes watershed are agriculture and forestry. It is presently unknown to what relative extent these sources contribute to fecal coliform loads. There are also numerous rural residences where other domesticated animals may be found. These rural residences may also contribute to the fecal coliform load if they have septic tanks or septic fields for their wastewater treatment.

3. TMDL Load Calculations

3.1 Current Load Evaluation

Fecal coliform loads have been calculated using the instream bacterial counts and the flow of the stream. The following equation can be used to calculate fecal coliform loads.

Equation 1. C x 1000mL/ L x 1 L/0.264 gallons x Q in gallons/day = cfu/day

Where: C = colony forming units/100mL
Q = stream flow in gallons/day

A traditional expression of the FC loading may be developed by setting one critical or representative flow and concentration, and calculating the fecal coliform load using Equation 1. The difficulty with this approach is in the determination of the appropriate flow or concentration value to use. For the purpose of calculating current loading on the this waterbody the average fecal coliform concentration for the May-October season was calculated using monthly LDEQ monitoring data on Bayou Des Cannes northeast of Jennings. In Bayou Des Cannes, the monthly fecal coliform counts for this season ranged from 7 cfu/100mL to 1,300 cfu/100mL over a 5-year period (January, 1994-Decembert, 1998). The average fecal coliform count for the May – October season is 309 cfu/100ml (see Appendix A). In addition, the average flow for Bayou Des Cannes for the May – October season is 568 ft^3/sec (see Appendix C). Using these values and Equation 1 it is estimated that the current loading for the May – October season is 4.29E12 cfu/day.

3.2 TMDL

Point sources usually have a defined critical receiving stream low flow such as the 7Q10 at which the criterion must be met. For nonpoint sources it is recognized that there may be no single critical flow condition. To address this condition, a TMDL fecal coliform loading curve for the recreational period (May 1 – October 31) has been generated as Figure 1. This TMDL loading curve was developed using Equation 1, substituting the criteria, 200 cfu/100 ml, for FC concentrations and varying flows. The attempt here is to show that while a TMDL may be expressed as a single point it can also be thought of as a continuum of points representing the criterion value and various flow values. This curve is not stream dependent but is dependent upon the designated stream criterion. Therefore, it may be applied to any stream with a like FC criterion. This curve represents the TMDL loading allocation for FC.

Figure 1. TMDL Fecal Coliform Loading Curve for the May – October season.
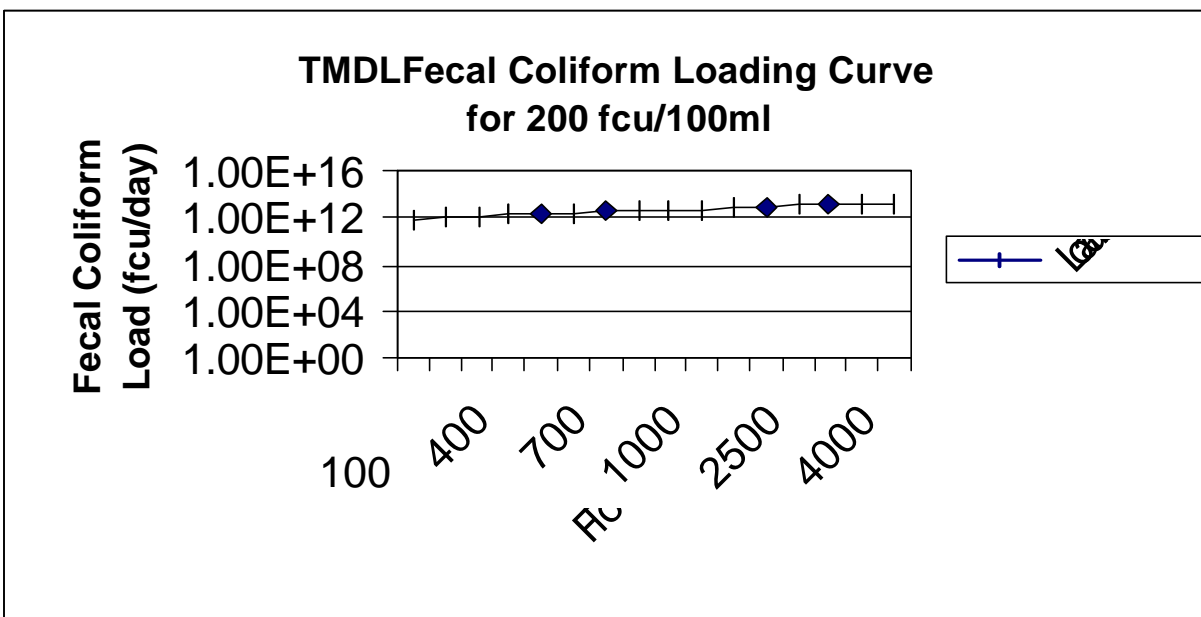
Utilizing Figure 1 one can select a stream flow and can quickly determine the FC loading value. The line formed by this series of points may be thought of as a boundary. At any given flow the loading may be below the line, within the boundary, or above the line.   FC load values falling above the line represent disproportionately high values relative to the standard. FC load values falling below the line represent low loads relative to the standard. To develop load reductions one simply needs to determine the appropriate flow value (x-axis) and see where it intersects the load allocation line.

The load reduction needed to meet the water quality standard for primary contact recreation in Bayou Des Cannes at 568 cfs is 1.51 E12 cfu/day (35% reduction)[1]. This was obtained by calculating the allowable TMDL at 568 cfs for the 200 cfu/100ml criterion (2.78 E12 cfu/day) and subtracting this load from the observed load (4.29 E12 cfu/day, see Appendix A).

Current Load – TMDL = Load Reduction

4.29E12 cfu/day – 2.78 E12 cfu/day = 1.51 E12 cfu/day

3.3 Wasteload Allocation (WLA)

The Louisiana Water Quality Regulations require permitted point source discharges of treated sanitary wastewater to maintain a fecal coliform count of 200 cfu/100 mL in their effluent, i.e., they must meet the standard at end-of-pipe. Therefore, there will be no change in the permit requirements based upon a wasteload allocation resulting from this TMDL.

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[1] Expression of the load reduction percentage was adjusted since publication of the draft TMDL based on public comment; see EPA's response-to-comments at http://www.epa.gov/earth1r6/6wq/tmdl.htm for further explanation.

Equation 1 can be used to calculate the total point source load (wasteload allocation) utilizing a fecal coliform count of 200 cfu/100 mL and the total volume of all the wastewater dischargers (3,301,966 gallons/day).

200 cfu/100mL * 1000mL/L * 1 L/0.264 gallons * Q gallons/day = WLA

Where Q = Total volume of sanitary wastewater discharges into Bayou Des Cannes

WLA for all dischargers = 2.50 E10 cfu/day

3.4 Load Allocation (LA)

The load allocation for each season for a given flow can be calculated using Equation 1 and the following relationship:

(TMDL@ given flow and criterion) - (WLA)= LA

LA for May – October season at an instream flow of 568 cfs = 2.75 E12 cfu/day

2.78 E12 cfu/day (TMDL@ 568 cfs) – 2.50 E10 cfu/day (WLA) = 2.75 E12 cfu/day

3.5 Seasonal Variability

Louisiana has established a seasonal water quality standard for bacteria based upon definition of a summer swimming season and winter secondary contact only. In development of this TMDL data for all seasons were evaluated and it was determined that a TMDL for the May - October season was needed to protect the primary contact recreation use.

3.6 Margin of Safety (MOS)

The Clean Water Act requires that TMDLs take into consideration a margin of safety. EPA guidance allows for the use of implicit or explicit expressions of the margin of safety or both. When conservative assumptions are used in the development of the TMDL or conservative factors are used in the calculations, the margin of safety is implicit. When a percentage of the load is factored into the TMDL calculation as a margin of safety, the margin of safety is explicit. In this TMDL for fecal coliform, conservative assumptions have been used and therefore, the margin of safety is implicit. These conservative assumptions are:

- Using average seasonal flows to calculate current loading to obtain load reduction.
- Treating fecal coliform bacteria as a conservative pollutant, that is, a pollutant that does not degrade in the environment (bacteria do die off in the environment)
- Using the more conservative 200 cfu/100mL standard rather than 400 cfu/100mL for the summer primary contact recreational season and 1,000 cfu/100mL rather than 2,000 cfu/100mL for the winter season.

- Using the design flow of the point source dischargers rather than actual average flow rates, which are typically much lower

4. Other Relevant Information

Utilizing funds under Section 106 of the federal Clean Water Act and under the authority of the Louisiana Environmental Quality Act, the LDEQ has established a program for monitoring the quality of the state's surface waters. The LDEQ Surveillance Section collects surface water samples at various locations, utilizing appropriate sampling methods and procedures for ensuring the quality of the data collected. The objectives of the surface-water monitoring program are to determine the quality of the state's surface waters, to develop a long-term database for water quality trend analysis, and to monitor the effectiveness of pollution controls. The data obtained through the surface-water monitoring program is used to develop the state's biennial 305(b) report (*Water Quality Inventory*) and the 303(d) list of impaired waters. This information is also utilized in establishing priorities for the LDEQ nonpoint source program.

The LDEQ has implemented a watershed approach to surface water quality monitoring. Through this approach, the entire state is sampled over a five-year cycle with two targeted basins sampled each year. Long-term trend monitoring sites at various locations on the larger rivers and Lake Pontchartrain are sampled throughout the five-year cycle. Sampling is conducted on a monthly basis or more frequently if necessary to yield at least 12 samples per site each year. Sampling sites are located where they are considered to be representative of the waterbody. Under the current monitoring schedule, targeted basins follow the TMDL priorities. In this manner, the first TMDLs will have been established by the time the first priority basins will be monitored again in the second five-year cycle. This will allow the LDEQ to determine whether there has been any improvement in water quality following implementation of the TMDLs. As the monitoring results are evaluated at the end of each year, waterbodies may be added to or removed from the 303(d) list. The sampling schedule for the first five-year cycle is shown below. The Mermentau River Basin will be sampled again in 2003.

> 1998 – Mermentau and Vermilion-Teche River Basins
> 1999 - Calcasieu and Ouachita River Basins
> 2000 – Barataria and Terrebonne Basins
> 2001 – Lake Pontchartrain Basin and Pearl River Basin
> 2002 – Red and Sabine River Basins
>
> (Atchafalaya and Mississippi Rivers will be sampled continuously.)

In addition to ambient water quality sampling in the priority basins, the LDEQ has increased compliance monitoring in those basins, following the same schedule. Approximately 1,000 to 1,100 permitted facilities in the priority basins were targeted for inspections. The goal set by LDEQ was to inspect all of those facilities on the list and to sample 1/3 of the minors and 1/3 of the majors. During 1998, 476 compliance evaluation inspections and 165 compliance-sampling inspections were conducted throughout the Mermentau and Vermilion-Teche River Basins.

5. Public Participation

When EPA establishes a TMDL, 40 C.F.R. § 130.7(d)(2) requires EPA to publicly notice and seek comment concerning the TMDL. Pursuant to an October 1, 1999, Court Order, EPA prepared this TMDL. After submission of this TMDL to the Court, EPA commenced preparation of a notice seeking comments, information and data from the general and affected public. Comments and additional information were submitted during the public comment period and this Court Ordered TMDL was revised accordingly. EPA has transmitted this revised TMDL to the Court, and to the Louisiana Department of Environmental Quality (LDEQ) for incorporation into LDEQ's current water quality management plan.

REFERENCES

LDEQ, 1993. *State of Louisiana Water Quality ManagementPlan, Volume 6, Part A: Nonpoint Source Pollution Assessment Report*. Louisiana Department of Environmental Quality, Office of Water Resources, Baton Rouge, La.

LDEQ, 1998. *State of Louisiana Water Quality ManagementPlan, Volume 5, Part B: Water Quality Inventory*. Louisiana Department of Environmental Quality, Office of Water Resources, Baton Rouge, La.

APPENDIX A Fecal Coliform data and loading calculations for each season.

Bayou Des Cannes northeast of Jennings, LA

November - April		FECAL COLIFORM MPN/100 ML		May - October		FECAL COLIFORM MPN/100 ML
DATE	TIME			DATE	TIME	
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12/15/1998	1005	800		10/28/1998	1018	30
11/23/1998	955	80		10/13/1998	1020	110
11/09/1998	1012	50		09/22/1998	1004	50
03/09/1998	950	3000		09/08/1998	1023	80
01/12/1998	1020	130		08/25/1998	1020	130
11/18/1997	1046	220		08/11/1998	959	50
03/10/1997	950	70		07/28/1998	1020	240
01/07/1997	1010	800		07/14/1998	952	500
11/18/1996	1040	16000		06/23/1998	1010	7
03/11/1996	940	70 .		05/11/1998	1028	50
01/08/1996	930	500		09/08/1997	1035	500
11/13/1995	930	300		07/14/1997	1010	500
03/14/1995	1043	9000		05/12/1997	1040	80
01/10/1995	1040	240		09/09/1996	1033	30
11/15/1994	1000	50		07/09/1996	1012	90
	Average =	2087		05/13/1996	1006	1300
% Exceedance of 2000/100ml =		20%		09/12/1995	1045	240
				07/11/1995	1100	240
				05/09/1995	1040	1100
				09/13/1994	1015	80
				07/12/1994	945	700
				05/10/1994	1040	700
					Average =	309
				% Exceedance of 400/100ml =		32%
		Flow cfs	Fecal Count (fcu)	Flow gal/day	Load fcu/day	
Current May - Oct Load		568	309	366451613	4.29E+12	
Allowable May - Oct Load		568	200	366451613	2.78E+12	
% Load Reduction May - Oct		55				

APPENDIX B Dischargers in subsegment.

NOTE: For copies of Appendix B please contact Ellen Caldwell, EPA Region 6, 1445 Ross Avenue, Dallas, Texas 75202 or call (214) 665-7513.

APPENDIX C Flow calculation methodology.

January 27, 2000

DETERMINATIONS OF AVERAGE STREAMFLOW FOR SELECTED LADEQ WATER QUALITY STATIONS IN LOUISIANA.

Note: *The* "average streamflow" is defined to be the annual average streamflow.

Bayou Des Cannes northeast of Jennings (DEQ # 0308 and 0647) - Based on the runoff for the USGS station on Bayou Des Cannes near Eunice, 2.11 CFS per square mile, and a drainage area for the 308 site of 368.69 square miles, the average strearnflow is estimated to be 778 CFS. . The May - October average flow is estimated to be about 73% of the annual average flow; the November - April average flow is estimated to be about 127 % of the annual average flow.

Bayou Nezpique at La. 104 north of Basile (DEQ 005) -- Based on the runoff for the USGS station on Bayou Nezpique near Basile, 1.89 CFS per square mile, and a drainage area for the 005 site of 327.62 square miles, the average streamflow is estimated to be 619 CFS. . The May - October average flow is estimated to be about 47% of the annual average flow**;** the November - April average flow is estimated to be about 153 % of the annual average flow.

Bayou Nezpique at La. 97 near Jennings (DEQ 309) -- Based on the runoff for the USGS station on Bayou Nezpique near Basile, 1.89 CPS per square mile, and a drainage area for the 309 site of 580 square miles, the average streamflow is estimated to be 1,096 CFS. The May - October average flow is estimated to be about 47**%** of the annual average flow-, the November - April average flow is estimated to be about 153 % of the annual average flow.

Bayou Nezpique at boat landing near Jennings (DEQ 651) - Based on the runoff for the USGS station on Bayou Nezpique near Basile, 1.89 CFS per square mile, and a drainage area for the 651 site of 585 square miles, the average streamflow is estimated to be 1, 106 CFS. The May - October average flow is estimated to be about 47**%** of the annual average flow; the November - April average flow is estimated to be about 153 % of the annual average flow.

Bayou Plaquemine Brule at Refinery (DEQ 650) - Based on the runoff for the USGS station on Bayou Des Cannes near Eunice (best available estimator), 2.11 CFS per square mile, and a drainage area for the 650 site of 331.87 square miles, the average streamflow is estimated to be 700 CFS. The May - October average flow is estimated to be about 73% of the annual average flow; the November - April average flow is estimated to be about 127 % of the annual average flow.

DETERMINATIONS OF AVERAGE STREAMFLOW FOR SELECTED LADEQ WATER QUALITY STATIONS IN LOUISIANA PAGE 2.

Bayou Boeuf at mouth (DEQ 668) - Based an the runoff for the USGS station an Bayou Courtableau near Washington, 1.56 CPS per square mile, and a drainage area for the 668 site of 234.33 square miles, the average streamflow is estimated to be 312 CFS. The May - October average flow is estimated to be about 53% of the annual average flow; the November - April average flow is estimated to be about 147% of the annual average flow.

Bayou Teche at Breaux Bridge (DEQ 03 1) -- Based on the adjusted runoff for the USGS station on Bayou Teche at Arnaudville and a subtraction of the estimated average flow for Bayou Fusilier, the estimated average streamflow is 760 CFS. The May - October average flow is estimated to be about 76% of the annual average flow; the November - April average flow is estimated to be about 124 % of the annual average flow.

Bayou Teche at Adeline (DEQ 030) – With the assumption that the average streamflow for the USGS station on Bayou Teche at Keystone Lock and Dam is the same as the average streamflow at Adeline, the estimated average streamflow for Site DEQ 030 is 491 CFS. The May-October average flow is estimated to be about 78% of the annual average flow; the November-April average flow is estimated to be about 122% of the annual average flow.

Vermilion River at Perry (DEQ 001) – Based on DEQ determinations for Vermilion River at Surrey Street in Lafayette using USGS data for the period 94-97, the average flow for the Vermilion River at Perry is about 750 CFS. For May-October, the average flow is estimated to be about 600 CFS; for November- April, the average flow is estimated to be about 900 CFS.